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CURRICULUM GUIDE

(INTERIM)

FOR

SENIOR HIGH SCHOOL SCIENCE

Including SCIENCE 10, SCIENCE 12, SCIENCE 20
CHEMISTRY 30 and PHYSICS 30

September 1962

This outline will replace the one published a year ago entitled Course Outline for Senior High School Science — Including Science 10, Science 12, Science 20, Chemistry 30 and Physics 30.

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MAIN OBJECTIVES FOR COURSES IN SCIENCE

Students should:

1. acquire facts, principles, concepts and appreciations in order to better understand and interpret their environment.
2. acquire some competence in critical thinking and the methods of science.
3. develop a scientific attitude.
4. gain some skill in the reading of and the analysis of current articles on scientific subjects.

Experimental work is to be considered an integral part of the course. Students should spend one day per week in the laboratory. The choice of experiments is left entirely with the teacher. Not all experiments can be covered therefore it is important to exercise care in the selection of those to be done. Matriculation students are expected to do the majority of exercises and problems at the end of each chapter.

CARE AND MAINTENANCE OF THE SCIENCE LABORATORY

1. Chemicals and equipment should be stored in a neat and orderly manner. Chemicals can well be arranged alphabetically. All equipment should be cleaned before being put away.
2. All apparatus should be kept in good repair. The teacher should be responsible for minor repairs. For major repairs equipment can usually be returned to the supply house from which it was purchased.
3. Damaged equipment (chipped glassware) should be discarded.
4. A yearly inventory should be taken each spring to determine basic needs. DO THIS NOW. The science teacher is responsible for seeing that chemicals and equipment are ordered and available as required.. Purchase of some of the major items of equipment may be spread over a term of several years.
5. A resourceful teacher will find many ways of improvising equipment for experimental work.
6. Care should be taken in storing chemicals, e.g. the kerosene level on sodium should be checked: water level on phosphorus, etc. Acids should be stored in a closed cabinet to prevent fumes from reacting with metal equipment.
7. The laboratory should be locked when a teacher is not present for supervision.
8. Students should be taught how to use and care for laboratory equipment.
9. A fire extinguisher should be provided in each science laboratory and should be easily accessible. Students should be instructed in the proper use of the extinguisher.
10. A first aid kit should be available.

Preparing Solutions for Use in Bench Reagent Bottles:

Methyl Orange indicator:	Dissolve one gram of methyl orange in 1000 ml. of water.
Phenolphthalein indicator:	Dissolve one gram of phenolphthalein in 700 ml. of methyl alcohol and dilute to 1000 ml. with water.
Ammonium hydroxide 6N	Add 400 ml. of concentrated ammonium hydroxide to 600 ml. of water.
Barium chloride 1N	Dissolve 122 grams of $BaC1_2$ $2H_20$ in 500 ml. of water and after the salt dissolved add sufficient water to make 1000 ml. of solution.
Hydrochloric acid 6N	Add 500 ml. of concentrated hydrochloric acid to 500 ml. of water.
Nitric acid 6N	Add 380 ml. of concentrated nitric acid to 620 ml. of water.
Silver nitrate 0.1N	AO.1 normal solution is suitable for the purposes of this course and may be made by adding 17 grams of silver nitrate to sufficient water to make 1000 ml. of solution.
Sodium chloride 1N	58.5 grams of sodium chloride plus enough water to make 1000 ml. of solution.
Sodium hydroxide 2.5N	100 grams of sodium hydroxide to enough water to make 1000 ml. of solution.
Sulphuric acid 6N	Add 200 ml. of concentrated sulphuric acid to enough water to make 1000 cc. of solution.

NOTE:

1. *Caution.* When mixing acid and water, always add the acid to the water slowly, stirring the solution.
2. Instructors may wish to dilute the above solutions further to meet the requirements of certain reactions.
3. See pages 69 - 70 - 71 of the Chemistry 30 Laboratory Manual for instructions re: preparation of other reagents.

GENERAL OBSERVATIONS CONCERNING THE SCIENCE LESSON

1. All lessons should stress and be illustrations of the scientific method. Conclusions should be based on actual observations wherever possible.
2. Principles illustrated by demonstrations and student experimental work should be emphasized so that the mechanics of the demonstration do not become the important factor.
3. Pictures and diagrams should be used freely. The teacher can easily build a personal file of illustrations taken from the text as well as the advertisements appearing in many periodicals, literature obtained from companies, etc. See the reference list.
4. Constant review on *back* work in the form of short (5 - to 10-minute) tests is valuable. Longer tests used at suitable points in the course should act as a guide to the teacher suggesting the introduction of new work or review of points.
5. Safety should be stressed at all times. The majority of accidents in school labs are direct results of students not understanding or not following simple directions. Make sure your students understand the reasons for doing things in a definite manner (such as adding the acid to the water when making a solution of sulphuric acid).
6. The vocabulary of science should be emphasized at all times.

LABORATORY EQUIPMENT FOR SCIENCE

Student Experimental Work

It is suggested that students should work in groups of two. Each group should be equipped with the following apparatus, which is considered to be a minimum. This apparatus should be stored at the laboratory station at which the group works. (Approximate cost per group of two — $50.00).

CHEMISTRY EQUIPMENT SCIENCE 10

APPARATUS (for a group of two)

Beakers 2 - 150 ml. capacity
1 - 250 ml capacity
1 mortar and pestle (small size)
1 Florence flask (500 cc)
1 deflagrating spoon
1 doz. test tubes (medium size, Pyrex)
2 test tube clamps
3 crucibles and covers (size '0')
2 four inch wire gauze (asbestos)
1 crucible tongs
2 evaporating dishes
1 Bunsen burner
1 Erlenmeyer flask (500 ml.)
2 rubber tube clamps
1 graduated cylinder (50 ml.)
1 test tube brush
1 set of ring stand and rings
1 funnel (small)
2 utility clamps
1 wire triangle (clay guards)
3 wide mouth gas bottles
1 four inch triangular file
1 wing top for Bunsen burner
1 spatula (small)
1 asbestos mat (12" square)
1 thermometer (-12 to 110° C)
1 pneumatic trough
6 reagent bottles (4 oz. size — named for chemical reagents, glass stoppers)

REAGENTS AND MATERIALS REQUIRED (based on a group of twenty students)

	Quantity
Alcohol, Methyl (local purchase)	1 gal.
Aluminum, sheet	1 sq. ft. 1/32" thick
Ammonium hydroxide	4 lbs.
Barium Chloride, xtals CP.	1 lb.
Barium Chloride, Tech.	1 lb.
Calcium Carbonate (marble chips)	5 lbs.
Calcium Chloride, Gran. USP.	5 lbs.
Copper, sheet (for strips)	1 lb. 1/32" thick
Copper Sulphate, xtals CP.	1 lb.
Cupric Chloride, anhydrous	¼ lb.
Hydrochloric Acid, concentrated Sp. G 1.19	6 lbs.
Iron filings	1 lb.
Iron nails (obtain locally)	
Lead, sheet	1 sq. ft. 1/16" thick
Lemon juice (local purchase)	
Litmus	4 ozs.
Manganese Dioxide CP.	3 lbs.
Magnesium ribbon	1 oz.
Mercuric Oxide CP.	¼ lb.
Methyl Orange	1 oz.
Nitric Acid USP	7 lbs.
Phenolphthalein	4 ozs.
Potassium Chloride	1 lb.
Potassium Chlorate CP.	2 lbs.
Salt (not iodized) Granular USP.	
Sand (local purchase)	5 lbs.
Silver Nitrate	
Sodium Hydroxide, pellets USP.	1 lb.
Sodium, metal	¼ lb.
Sodium Sulphate, xtals CP.	1 lb.
Solder, spool (local purchase)	
Sugar, cubes (local purchase)	
Sulphur (flowers of S.) powdered	1 lb.
Sulphuric Acid, SP. G. 1.83	9 lbs.
Vinegar (local purchase)	
Zinc (Mossy) (low in As, Fe and Pb)	1 lb.

CP—Highest degree of purity. USP—Less Pure Tech—Contains some impurities

PHYSICS EQUIPMENT SCIENCE 10

Minimum Apparatus for a Class of 20 - 24 Students

1 Brownian movement apparatus
*1 set of Pascal Vases with base attachment
1 set of capillary tubes
1 barometer
*1 set of Magdeburg hemispheres
1 exhaust pump with base and bell jar
1 Torricellian tube
1 open tube manometer
1 Bourdon pressure gauge
1 lift pump model
1 Boyle's law apparatus
12 thistle tubes
1 Venturi tube
3 balance scales — (Harvard Trip)
3 sets of weights
5 glass U-tubes
5 lb. bottle methyl alcohol
5 lb. bottle carbon tetrachloride
5 lbs. mercury
5 thermometers (centigrades)
5 calorimeters
2 coefficient of linear expansion apparatus with spherometer and rods
2 adhesion disks
1 adjustable thermostat
4 dilatometers
1 ball and ring (hand form)
1 bi-metalic strip
2 Charles' Law tubes (Waterman form)
2 boilers or steam generators
2 sets specific heat specimens
4 water traps (for heat of vaporization)
4 meter sticks
24 beakers
glass tubing
rubber delivery tube
rubber stoppers (6 lb. assorted)
4 graduated cylinders 100 cc
2 glass tube cutters
retort stands
clamps and rings
12 Bunsen burners or propane burners
2 sets of tuning forks (unmounted)
1 set of tuning forks (mounted)
2 rubber hammers
*1 Kundt's tube
*1 pint cork dust
1 steel rod
1 brass rod
1 coil spring (longitudinal vibrators)
1 electric bell in vacuo
1 rotator (hand driven, worm drive)
1 Savart's toothed wheels
1 Crova's disc
1 combined siren and color disc
1 sonometer with strings of varied densities and diameters
1 set of collision balls
2 sets of resonance tubes

* *Optional equipment*

EQUIPMENT REQUIRED BY THE TEACHER FOR GROUP OF ANY SIZE

Balances, Chemical:

There should be at least one chemical balance capable of weighing to 0.01 grams. In addition, a rough balance for making dilute and bench solutions is a handy piece of equipment. See Physics List.
Balances suitable for school laboratories can be purchased from $50 to $200 and are obtainable from scientific instrument supply houses.

Glass Tubing:

A supply of glass tubing which can be issued to students for glass work should be kept in stock. A popular size and type is the soft glass tube with the 6 mm. outside diameter. It costs about $1.00 per pound. Fifteen to twenty pounds should be kept in stock for a class of twenty students. It can be used for delivery tubes for gas production, making of wash bottles and exercise in glass work. Do not buy the Pyrex tube as it requires too much heat to soften it to the stage where it can be worked.

Rubber Tubing:

A supply of rubber tubing is necessary for connecting gas burners, delivery tubes, etc. The usual rubber tubing for connecting gas burners has an inside bore of ¼ of an inch. It costs about 25c per foot. Delivery tubes made of 6 mm. glass may be connected by using rubber tubing with a 3/16-inch bore (inside diameter) costing about 20c per foot.

Rubber Stoppers:

A quantity of rubber stoppers, solid, one-hole, are needed. They sell in various sizes at about $5.00 per pound. The most useful sizes are No. 2, 3 and 4. In some cases it is well to have a few No. 5 stoppers as well.

Beakers:

An assortment.

Gas Generators:

The Kipp generator for gases is practically a "must" for any school laboratory producing gas. Great care should be exercised in any work with hydrogen gas. Hydrogen sulphide cartridges are available.

Graduated Cylinders:

One or two graduated cylinders of one liter capacity are necessary in the making of stock solutions. A one-liter cylinder costs about $7.50.

Filter Paper:

Several packages, about 9 cm. diameter are needed costing about 35c per package.

Litmus Paper:

Red and blue, obtainable in books of 100 test strips each are needed. About twenty books of each, running to approximately $6.00 give a suitable stock.

Distilled Water, etc.

A supply of distilled water should be available. It is necessary for making solutions of silver nitrate especially if tap water contains chlorine or any of the chlorides. It should be used for all stock solutions. It costs about $1.00 for five gallons plus deposit on the container. Obtain locally. Cloths, soap, towels, matches, splints, etc., are always necessary.

Crookes Tube and Induction Coil, Pith Balls, Rods, Fur and Silk Cloth:

This equipment is desirable to demonstrate the lessons on the electron. It is usually found in the physics laboratory and should be borrowed for the lessons indicated in the text.

SCIENCE 10

The prescribed text for Grade X is INTRODUCTORY CHEMISTRY AND PHYSICS by Pickard and Radomsky. Students in Grade X who are not on the text rental plan will be expected to purchase the text.

The course outline sets out a logical arrangement of the concepts and must be followed (Section 1, Section 2, then Section 3) because of the large number of students who transfer during the year. For large schools where the number of classes make it desirable to offer both the chemistry and physics simultaneously to different classes, transfer presents no problem.

SECTION 1: AN INTRODUCTION TO SCIENCE

UNIT 1 — A Short History of Science

Chapter 1: Our Debt to the Past

- Science is Knowledge
- The Early Period
- The Philosophers of Greece
- The Egyptian Scientists
- The Roman Contribution
- The Dark Ages
- The Middle Period
- The Scientific Method
- The Later Period
- The Progress of Today is the Result of the Past
- The Value of Studying Science

UNIT 2 — Matter

Chapter 2: Matter: Its Classification

- States of Matter
- Classes of Matter
- Properties of Matter
- Another Important Characteristic of a Chemical Reaction
- Heat and the Formation of Chemical Compounds
- Energy
- Measurement, A Tool of the Scientist

Chapter 3: Matter: Its Composition

- The Distribution of the Elements
- Compounds
- Law of Definite Proportions
- The Atom
- Atomic Weights
- Symbols
- Molecules

Chapter 4: Matter: Its Structure

- Introduction to the Periodic Chart of the Elements
- The Arrangement of Particles in the Atom
- A Guide for the Construction of Diagrams of Atoms

SECTION 2: AN INTRODUCTION TO CHEMISTRY

UNIT 3 — The Language of Chemistry

Chapter 5: Symbols and Formulae: The Shorthand of Chemistry

Why do Elements Lose and Gain Electrons?
Electrovalent Compounds
Covalent Compounds
Transfer of Electrons as Well as Sharing
Electrons May Be Represented by "Bonds"
Valence
Metals and Nonmetals
Multiple Valence
Writing of Formulae
Radicals

Chapter 6: Chemical Equations: Short Stories of Reactions

The Writing of Equations
Types of Chemical Reactions
Another Use of the Equation

UNIT 4 — Some Substances Man Has Learned to Use

Chapter 7: Oxygen: The World's Most Abundant Element

History of Oxygen
The Preparation of Oxygen
Properties of Oxygen
Uses of Oxygen

Chapter 8: Hydrochloric Acid: A Typical Acid

Strong and Weak Acids
Hydrochloric Acid
General Preparation of Acids
Commercial Preparation of Hydrochloric Acid
Properties of Hydrochloric Acid
Definition of an Acid
Uses of Hydrochloric Acid

Chapter 9: Sodium Hydroxide: A Typical Base

The Preparation of Sodium Hydroxide in the Laboratory
Properties of Sodium Hydroxide
Neutralization
The Preparation of NaOH in Industry
Uses of Sodium Hydroxide

Chapter 10: Sodium Chloride: A Typical Salt

Occurrence
Commercial Production
The Refining Process
Sodium Chloride in Industry
Salt as a Class

SECTION 3: AN INTRODUCTION TO PHYSICS

UNIT 5 — Mechanics of Fluids

Note: Unit 5 is optional except for Chapter 12 and Chapter 13 and Experiment 13 in Chapter 15.

Chapter 11: Molecular Forces in Liquids

Sizes of Molecules
Molecular Motion
The Brownian Movement
Evaporation
Osmosis
Cohesion and Adhesion
Surface Tension
Capillarity

Chapter 12: Pressure in Liquids at Rest
Liquids Exert Pressure in All Directions
Liquid Pressure Perpendicular to the Surface
The Measurement of Pressure in Liquids
Liquid Pressure is Proportional to Density
Force and Pressure
The Pressure at a Point in a Liquid
The Total Force on the Bottom of a Container
The Total Force Against the Side of a Container
Dams
Water Systems
Pascal's Principle and the Transmission of Pressures
The Hydraulic Press
Force Ratio

Chapter 13: Pressure in Gases
The Atmosphere
Why Do Liquids Rise in Exhausted Tubes?
The Mercury Barometer
The Aneroid Barometer
Calculation of Total Pressure
The Open-Tube Manometer
The Closed-Tube Manometer
The Bourdon Pressure Gauge
The Siphon
The Lift Pump
Compression and Expansion of Gases

Chapter 14: Fluids in Motion
Pressure and Velocity
The Venturi Tube
The Insect Sprayer
The Carburetor
The Curving Baseball

Chapter 15: Experiments in the Mechanics of Fluids

UNIT 6 — Heat

Chapter 16: Heat and Temperature
Nature of Heat
Effects of Heat on a Body
Heat and Temperature
Thermometers
Determining the Fixed Points on a Thermometer
Marking Degrees on a Thermometer
Conversion From One Temperature Scale to the Other

Chapter 17: Expansion of Solids
Coefficient of Linear Expansion
Coefficients of Area and Volume Expansion

Chapter 18: Expansion of Liquids
Peculiar Expansion of Water: Its Maximum Density

Chapter 19: Expansion of Gases
Determining the Coefficient of Expansion of a Gas
The Kelvin or Absolute Temperatures
The General Gas Law: A Combination of Charles's and Boyle's Laws
Standard Temperature and Pressure
Relation Between Pressure and Temperature

Chapter 20: Specific Heat and Thermal Capacity
- Units of Heat
- Thermal Capacity
- Specific Heat
- Heat Required to Raise the Temperature of a Substance
- To Find the Thermal Capacity of a Substance
- Water Equivalent
- Prevost's Law of Heat Exchange
- Specific Heat of Solids
- Specific Heat of Liquids

Chapter 21: Latent Heat
- Change of State
- Latent Heat of Fusion
- Measuring the Heat of Fusion
- Latent Heat of Vaporization
- Measuring the Heat of Vaporization of Water

Chapter 22: Experiments on Heat

UNIT 7 — Sound

Chapter 23: Production, Propagation, and Velocity of Sound
- Sources of Sound
- Medium Necessary to Transmit Sound
- Velocity of Sound in Air and Other Media
- Reflection of Sound: Echoes
- Acoustics of Auditoriums

Chapter 24: Transmission of Sound
- Transverse Vibrations
- Longitudinal Vibrations
- Sound Waves are Longitudinal Vibrations
- Relations Between Velocity, Wave Length, and Frequency
- Beats

Chapter 25: Distinguishing Features of Sound
- Pitch
- Audible Frequencies
- Intensity and Loudness
- Quality

Chapter 26: Resonance: Sympathetic Vibrations
- Resonance in Closed Tubes
- Determining the Velocity of Sound by Resonance
- Resonance in Open Tubes
- Overtones in Organ Pipes

Chapter 27: Laws of Stretched Strings
- Law of Lengths
- Law of Tensions
- Law of Diameters
- Law of Densities

Chapter 28: Experiments on Sound

SCIENCE 12

It seems reasonable that all students should have an opportunity to gain some knowledge of the field of science, but all students do not have the desire to follow a matriculation program of studies in science. The Alberta Royal Commission on Education expressed, in recommendation 69, the need for a survey-type course in physical science for students attempting a non-matriculation program. The course in Science 12 could be an introduction to Science 10 or it could be terminal in nature.

The Science 12 text is PHYSICAL SCIENCE FOR SECONDARY SCHOOLS, by Hogg, Cross and Davis. The course consists of the first six units. Unit VII may be treated if time permits.

UNIT I: The Earth As It Began
1. The Earth — Its Origin
2. Waters of the Earth
3. The Earth's Atmosphere

UNIT II: Earth, The Abode of Man

4. The Earth — Its Shape and Motion
5. Rocks of the Earth (1)
6. Rocks of the Earth (2)
7. The Changing Earth
8. The Formation of Mountains
9. The Record of Rocks
10. Earth History

UNIT III: Weather

11. Winds and Air Masses
12. Fronts and Storms
13. Weather Forecasting (1)
14. Weather Forecasting (2)
15. What is Climate?

UNIT IV: Chemistry, Fuels and Some Industries

16. Oxygen and Hydrogen
17. Water, An Important Compound
18. A Chemist's Language and Shorthand
19. The Structure of the Atom
20. Fuels: Solid, Liquid and Gaseous
21. Some Chemical Industries
22. Metals
23. Foods, Drugs and Antiseptics

UNIT V: Electricity

24. Magnetism
25. Static Electricity
26. Current Electricity
27. Heat and Light from Electricity
28. Power from Electricity

UNIT VI: Communication

29. What is Sound?
30. Sound Instruments
31. The Telephone and Some Electronic Devices
32. Radio and Television

UNIT VII: Atoms and Stars (Optional)

33. Power from Atoms
34. The Sun
35. The Solar System
36. Stars and Galaxies

No specific time distribution for the units is specified since it is expected that teachers should be free to expand or condense topics as they see fit to meet the needs and interests of the class. The inference is that experienced teachers should be in charge of such classes so that satisfactory adaptions of content and method can be made readily. Experimental work must be included in the program.

Demonstrations and Experiments

The Science 12 class is expected to use the laboratory manual ACTIVITIES IN PHYSICAL SCIENCE which is designed to accompany the book PHYSICAL SCIENCES FOR SECONDARY SCHOOLS. The class should perform the first seventeen experiments in the manual and complete the exercises given on pages 39 - 111.

Also as many class demonstrations should be performed as time and equipment make possible. The students should themselves try the "Things to Do" given in the text.

SCIENCE 20

The following outline is intended for all schools during 1962-63. The sequence of physics then chemistry is to be followed to avoid difficulty of student transfer during the school year.

The texts for the physics-chemistry (Science 20) are as follows:

1. PHYSICS FOR SECONDARY SCHOOLS, Alberta Edition, Eubank, Ramsay, Rickard
2. CHEMISTRY FOR SECONDARY SCHOOLS, Advanced Edition, Croal, et al.

All students should be requested to buy these two texts.

Laboratory experience should be provided. The teacher's reference for this work is EXPERIMENTS IN LABORATORY CHEMISTRY, Couke, Croal, Louden (Copp Clark).

The course consists of a physics section and a chemistry section as outlined below:

A. PHYSICS SECTION

Chapter 1: Introduction
- The Meaning and Scope of Physics
- Some Early Developments
- The Methods of Science

UNIT I: Mechanics

Chapter 2: Measurement
- Systems of Measurement
- Units of Measurement
- Calculations Based on Measurements
- Questions on Measurements

Chapter 3: Density and Specific Gravity
- Meaning of Density
- Density of Water
- Meaning of Specific Gravity
- Density of Gravity of Various Substances
- Questions on Density and Specific Gravity

Chapter 4: Buoyancy
- Introduction to Buoyancy
- Archimedes' Principle
- Principle of Flotation
- Hydrometers and Their Uses
- Other Applications of Buoyancy
- Questions on Buoyancy

Chapter 5: Force, Work and Power
- Meaning of Force
- Measurement of Force
- Meaning of Work
- Measurement of Work
- Meaning of Power
- Units of Power
- Questions on Force, Work and Power

Chapter 6: Experiments on Mechanics

UNIT II: Light

Chapter 7: Nature and Propagation of Light
- Nature of Light
- Sources of Light
- Transmission of Light
- Pin-hole Camera
- Shadows and Eclipses
- Velocity of Light
- Theories of Light
- Questions on Nature and Propagation of Light

Chapter 8: Photometry
Introduction
Illuminating Power
Law of Inverse Squares
Intensity of Illumination
The Importance of Proper Illumination
Photometers
Questions on Photometry

Chapter 9: Reflection of Light — Mirrors
The Laws of Reflection
Regular and Diffuse Reflection
Images in Plane Mirrors
To Locate Images in Plane Mirrors
Plane Mirror Systems
Curved Mirrors
Images in a Concave Mirror
Images in a Convex Mirror
How the Eye Sees the Image
The Mirror Formulae
Applications of Mirrors
Questions on Reflection of Light

Chapter 10: Refraction of Light — Lenses
Meaning of Refraction
Explanation of Refraction
Index of Refraction
Refraction Through a Glass Plate
Refraction Through Prisms
Total Reflection
Atmospheric Refraction
Lenses
Focal Length of Lenses
Images in Convex Lenses
Images in Concave Lenses
The Lens Formulae
Applications of Lenses
Questions on Refraction of Light

Chapter 11: Colour
Introduction to Colour
Composition of White Light
The Rainbow
Beyond the Visible Spectrum
Spectrum Analysis
Nature of Colour
Colour Printing
Chromatic Aberration
Questions on Colour

Chapter 12: Optical Instruments (Optional)
The Camera
The Human Eye
The Magnifying Glass
The Compound Microscope
The Telescope
The Slide Projector
Questions on Optical Instruments

Chapter 13: Experiments on Light

Chapter 14: Modern Developments in Physics (Optional)

This Twentieth Century
- Cathode-Ray Oscilloscope
- Television
- Radar
- The Electron Microscope

Nuclear Physics
- Radioactivity
- The Structure of the Atom
- Isotopes
- Artificial Transmutation
- Nuclear Fission
- Nuclear Reactors
- Atomic Fusion

B. CHEMISTRY SECTION — Suggested time — 4 months

Note concerning laboratory work: Some teachers have found difficulty in supplying laboratory exercises to cover the chemistry of Science 20. Course material for demonstrations as well as class experiments in this section of the work may be found in EXPERIMENTS IN LABORATORY CHEMISTRY by Couke, Croal, Louden, published by Copp Clark, Toronto. The cost of this text is about $2.00. Problems involving percentage composition weight to weight, weight to volume and volume to volume relationships should be stressed.

UNIT I: Review of Science 10, Chemistry Section—Much of this review of Science 10 will be incidental and used throughout the course to introduce new work. However, as a general introduction certain terms should be discussed and definitions established. These terms should include: element, compound, atom, molecule, atomic and molecular weights. The four main types of chemical reactions should be reviewed as well as the method of writing and balancing equations.

UNIT II: Naming Compounds—In addition to the study of the system used in naming compounds this should include practice in the writing of formulae. Pages 139 - 146.

UNIT III: Mathematics of Chemistry

Review of percentage composition.

Review of weight to weight problems, pages 147, 148, Questions page 151. The Gas Laws (Review of Science 10 Physics) pages 89 - 99.

Guy-Lussac's Law of Volumes and Gram Molecular Relationships of Weight to Volume in Gases, pages 105 - 106, Questions pages 152.

Calculations involving the finding of simple and true formulae from percentage composition of a compound, pages 119 - 123.

UNIT IV: Ionization

Study of the terms referring to water and solution, pages 56 - 80. Study of ionization, pages 153 - 163. Include: (1) Electrolysis of water. Acids, bases, salts, neutralization, (review plus ionization characteristics). (2) Hydrolysis.

UNIT V: The Periodic Classification of the Elements

The Periodic Table, pages 234 - 239. This study should include the relationship between the atomic structure of the elements and the table. Review pages 133 - 138 and the table found in the front-end paper.

Application of the Periodic Table as seen in two families of elements.

(a) The Halogens
1. Atomic structure—see front-end paper.
2. Comparison of properties of chlorine (page 221), bromine (page 228), and iodine (page 230).

(b) The Alkali Metals
1. Atomic structure—see front-end paper.
2. Properties, pages 240 - 241.

UNIT VI: (Optional)

Two Gases

Hydrogen, pages 42 - 55.

Nitrogen and the Atmosphere, pages 33 - 41.

CHEMISTRY 30

Information on Course Content and Laboratory Exercises

1. Authorized Text

CHEMISTRY FOR SECONDARY SCHOOLS, Advanced Edition, Croal et al.

2. Course Content

The course consists of Chapters 10 - 15 (review) and Chapters 16 - 33 (new material). Owing to the length of the course Chapters 24, 25 and 26 are to be considered as material for reading and additional study if time permits. These chapters are NOT included in the work that will be covered in the Departmental Examination.

Chapters 10 - 15 have been included in order to provide for the necessary review of the fundamental mathematics of chemistry. It is suggested that no longer than four weeks be used for this review.

3. Demonstrations and Experiments

The revised laboratory manuel consists of twenty laboratory exercises, eleven of which include demonstration material. Students will be expected to perform not fewer than fourteen laboratory exercises, including the obligatory exercises, 1, 2, 3, 4, 7, 13, 17, 18, 20, 23, 24 (1958 LABORATORY EXERCISES IN CHEMISTRY 30). Additional experimental material may be found in EXPERIMENTS IN LABORATORY CHEMISTRY referred to in Science 20.

4. Equipment

A list of equipment needed for the prescribed experiments is contained in LABORATORY EXERCISES.

PHYSICS 30

Information on Course Content and Laboratory Exercises

1. Authorized Text

ELEMENTARY PHYSICS, Littler

2. Course Content

(a) The content selected from the text consists of materials on three topics: Mechanics, Heat and Electricity.

(b) The following portions of the text are used:
1. Mechanics: Chapters 1 - 9 inclusive.
2. Review: Chapters 10 and 11.
3. Heat: Review Chapters 13 - 18 inclusive and Chapter 21.
4. Electricity: Chapters 33, 34, 36 up to and including "Solenoid," 27, 38 and 39.

(c) In addition to the above it will be very desirable to commence the course by teaching the Metric System of measurement. (See Experiment 1, LABORATORY EXERCISES.)

3. Demonstrations and Experiments

Both these devices should be regular procedures of teaching the course.

(a) Experiments:
The revised LABORATORY EXERCISES consists of twenty experiments from which students are expected to perform.
Each of Experiments 1 - 11, inclusive, consists of two parts. In each case, PART B is stated as a follow-up problem to accompany PART A.
PART B is provided as extra work for the better students; its use is optional and at the discretion of the teacher.

(b) Demonstrations:
In addition to the experiments described in LABORATORY EXERCISES, the text provides ample suggestions for demonstrations.

4. Equipment

A list of specific equipment needed for the prescribed experiments is contained in LABORATORY EXERCISES.

5. Text

The authorized text was selected because of its precise descriptive and quantitative treatments of the selected topics.

These qualities of precise statement and accurate calculation will become, it is hoped, specific objectives in the teaching of this course.

SUITABLE REFERENCE MATERIAL

(Prices subject to change)

Periodicals:

The Science Teacher — Journal of the National Science Teachers' Association. Published monthly by the Association at 1201 Sixteenth Street, N.W., Washington 6, D. C. Membership of $6.00 includes publications and services.

Science News Letter — A weekly summary of current science, published every Saturday by Science News, Inc., 1719 N Street, N.W., Washington 6, D. C.

School Science and Mathematics — A practical journal for all teachers of mathematics and science. It brings you the latest science articles, new methods for presenting old teaching problems, the new ideas of educational leaders, interesting questions for inquisitive minds, news of the latest books, descriptions of all new apparatus. Central Association of Science and Mathematics Teachers, Inc., P.O. Box 408, Oak Park, Ill.

Endeavour — A British quarterly scientific journal whose purpose is to provide scientists with news of the progress of science. No charge is made for "Endeavour." Imperial Chemical Industries Limited, Millbank, London S.W. 1.

Science News — A publisher's leaflet which gives articles and news of interest to science teachers. Free for the asking, write A & B Science News, Allyn and Bacon, Inc., 150 Tremont St., Boston 11, Massachusetts.

Science News — Published eight times during the school year by Science Publications of Canada. Subscriptions and business correspondence should be addressed to 25 Hollinger Road, Toronto 16, Ontario. Editorial correspondence is received at the Montreal office: Box 340, Postal Station Westmount, Montreal 6, Quebec. Annual group subscriptions: 15 or more copies, $1.00 per student; 2 to 14 copies, $1.15 per student; teacher's copy free with 10 or more subscriptions; single annual subscription, $1.50.

Journal of Chemical Education — 20th and Northampton Streets, Easton, Penn. Annual subscription $4.50.

Periodicals for Teachers and Students

Science World — Taking over where the textbook leaves off, the "Science World" offers a wide range of appealing materials for the general student as well as the scientifically talented. The Teachers' Edition includes teaching suggestions for each issue, feature articles, references for further student reading and research. Published every two weeks, the "Science World" brings today's exciting world of science and technology into your classroom. $1.50 per year with Teachers' Edition free with ten copies or more. Mail orders to "Science World," 33 West 42nd St., New York 36, New York.

Tomorrow's Scientists — Is published four times a year for science students. While the pamphlet "Teaching Tomorrow's Scientists" is a teacher's guide or key for use with "Tomorrow's Scientists." It gives information on where to get things, useful films and books and other tips on teaching. Published by the National Science Teachers Association, 1201 Sixteenth St., N.W., Washington 6, D. C.

Science Materials:

Experiment-of-the-Month Club — Once each month you will receive a Club Experiment Kit complete with chemicals, special equipment and instruction booklets. For example, the first month you will get a kit on Properties of Matter. It shows how we know that matter is made up of atoms and molecules, $24.95, covers a full year's membership Write to Experiment-of-the-Month Club, P. O. Box 325, Danbury, Conn.

Things of Science — Once a month members receive a blue package with objects of science to be handled, experimented with; objects that are new, objects that are old, sometimes odd objects hard to find, sometimes familiar objects needed to complete suggested experiments. Along with these objects of science is an explanatory leaflet and museum-style cards with which to identify the objects for exhibit purposes and further study. $6.00 per year. Science Service, 1719 N Street N.W., Washington 6, D. C. Kits for the past four months were: Static Electricity, Non-woven Fabrics, Astronomy and Butterflies.

The Science Materials Center — Adaptable to home and school use each Science Materials Center "Portable Laboratory" is the result of research, testing and perfecting, so that a single unit can provide all the materials, equipment and instruction needed to master a specific area in the study of basic scientific principles. Send for catalog and price list from: Science Materials Center, 59 Fourth Avenue, New York 3, New York. The following are a few examples of the materials they have: Ultra-Violet Science Laboratory, Light Polarizer Laboratory, Pre-Electricity Physics Laboratory, Computer Circuits Laboratory, Color Spectroscope Laboratory.

Books:

Successful Devices in Teaching Chemistry — Paul Westmeyer. ($3.00) J. Weston Walch, Box 1075, Portland, Maine.

Experiments in Laboratory Chemistry — Croal, Couke, Louden. ($2.00) Published by Copp Clark, Toronto.

Science Model Making — R. R. Hopwood ($1.20) Describes dozens of models and how to make them; like electric motor, electric bell, pinhole camera, etc. Published by Longmans Canada Limited, 137 Bond Street, Toronto 2, Ontario

Science Experiences with Inexpensive Equipment — C. J. Lyne
Science Experiences with Home Equipment — C. J. Lyne
Sciences Experiences with Ten-Cent Store Equipment — C. J. Lyne

Each of the above books illustrates, describes and explains 200 science experiences. These three books differ from other books in this respect: they describe 600 experiences students can have in their own home, with equipment that is found in the home, or can be purchased locally. Published by D. Van Nostrand Company Ltd,. 25 Hollinger Road, Toronto 16.

Teaching High School Science: *A Sourcebook for the Biological Sciences* — Moreholt, Brandwein, Joseph.

Teaching High School Science: *A Sourcebook for the Physical Sciences* — Moreholt, Brandwein, Joseph.

The two books provide teaching techniques, procedures, demonstrations, projects, experiments and suggestions for the science teachers. The procedures described are typical of the kind of things that teachers do or want to do, as they teach the biological or physical sciences—in the variety of forms this takes. Published by W. J. Gage Limited, 1500 Birchmount Road, Box 550, Scarborough, Ontario.

Illustrated Encylopedia of Modern Science, 1959—A complete reference work for the school library. This huge volume reprints all the scientific entries in the 20-volume Grolier Encyclodpedia, plus additional articles, photographs and color illustrations. ($29.95) Thomas Allen Ltd., 266 King Street West, Toronto 2B, Ont.

A New Dictionary of Chemistry—Miall and Miall. Brief explanation of terms used in chemistry and chemical engineering. ($14.00) Longmans Canada Limited, 137 Bond Street, Toronto 2, Ontario.

Dictionary of Physics — J. Gray. Covers all branches of Physics and is useful to physicists and physics students in schools and universities and their teachers, ($15.30) Longmans Canada Limited, 137 Bond Street, Toronto 2, Ontario.

The Chemical Elements — Completely up to date, fully indexed, invaluable for reference. Contains the story of each element, its properties, sources, the most important varieties (isotopes), characteristic compounds and its place in the periodic table. (55c) 10 or more at 50c postage prepaid. Science Service, 1719 N Street, N. W., Washington 6, D. C.

Your Science Fair — Welte, Dimond, Friedl. ($2.75) Burgess Publishing Company, 426 South 6th Street, Minneapolis 15, Minnesota.

Miscellaneous Materials:

Chemistry Recordings — Part I contains the name, spelling, atomic weight, atomic number and valence of 42 chemical elements. Part II contains the name, spelling and correct pronunciation of 86 important terms used in Chemistry. Part III contains the name and identification of 98 technical terms used in atomic science. Order from Audio Educational Aid, Department 53, Box 250, Butler, Missouri. The records are 33 1/3 r.p.m. (over 40 minutes) $3.65.

The Elemental Slyd-Rul — Tells you at a glance, symbol, weight, density, number, valences, color, melting and boiling point in °C for the 98 elements. ($1.00 prepaid). The Slyd-Rul Company, Canaan, New York.

The Essentials of Chemistry — 1956 — Graham and Cragg; Clarke, Irwin Company.

The Elements of Chemistry — 1959 — Cragg, Graham, Young; Clarke, Irwin Company. (Laboratory manual for the above)

How to do an Experiment — Goldstein; W. J. Gage Limited

Physics a Basic Science — Burns, Verwiebe, Hazel and Van Hooft; Van Nostrand Co. Ltd.

Teachers should watch for free materials.

e.g. Free publications, trade magazines, etc., (e.g. Imperial Oil Review, C.I.L. Oval, Monsanto Magazine).

Free materials (e.g. Alcan Kit; Sifto Salt Kit, etc.)

See "Classroom Aids for Teachers" for a more complete listing of free materials.

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